Application No.: 10/561,536

REMARKS

I. Introduction

In response to the Decision on Appeal dated February 16, 2011, Applicants have amended independent claim 1. Support for the amendment to claim 1 may be found in paragraph [0034] of the specification. No new matter has been added.

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 1-5 and 22-23 Under 35 U.S.C. § 103

Claims 1-5 and 22-23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Thum & Lorenz (Centre of Darmstadt College of Higher Education, pp. 667-673, Vol. 84, No. 26, English Translation) in view of Housh et al. (Selection and Application of Magnesium and Magnesium Alloys," Vol. 2, ASM Handbooks Online) and Hawley's Condensed Chemical Dictionary (14th Ed., revised by Richard Lewis, Sr.), and further in view of Higgins (Engineering Metallurgy, Part I: Applied Physical Metallurgy, 6th Ed., pp.90-94) and Callister, Jr. (Materials Science & Engineering, An Introduction, 6th Ed.) with evidence from Webster's New World Dictionary (3rd College ed., Victoria Neufeldt, Editor).

With regard to the present disclosure, amended claim 1 recites a magnesium-based alloy screw having a head portion and a thread portion, wherein the screw is formed from a drawn wire made of a magnesium-based alloy, and the wire has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less; wherein the tensile strength of the screw is 220 MPa or higher, and the magnesium based alloy contains Al: 5.5 to 7.2% by mass, Zn: 0.4 to 1.5% by mass, Ni: 0.05% by mass or less, and Si: 0.1% by mass or less, or the

magnesium based alloy contains Al: 8.1 to 9.7% by mass, Zn: 0.35 to 1.0% by mass, Mn: 0.13% by mass or more, Cu: 0.1% by mass or less, Ni: 0.03% by mass or less, and Si: 0.5% by mass or less.

One embodiment of the present disclosure teaches a wire that is formed into a screw by drawing a magnesium-based alloy has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less, and the magnesium based alloy contains Al: 5.5 to 7.2% by mass, Zn: 0.4 to 1.5% by mass, Ni: 0.05% by mass or less, and Si: 0.1% by mass or less, or the magnesium based alloy contains Al: 8.1 to 9.7% by mass, Zn: 0.35 to 1.0% by mass, Mn: 0.13% by mass or more, Cu: 0.1% by mass or less, Ni: 0.03% by mass or less, and Si: 0.5% by mass or less. As a result of this feature, a screw having excellent tensile characteristics can be formed, even at temperatures lower than the usual temperature at which magnesium-alloys are worked.

It was stated in the Decision on Appeal that a skilled artisan would have reasonably expected the temperatures used in a sheet metal drawing procedure to be applicable in an analogous wire-drawing method, and that Housh discloses deep drawing at temperatures which overlap those used in the claimed drawing method. Applicants respectfully disagree.

The term "draw" is defined in Hawley's Condensed Chemical Dictionary as "gradually reduce the diameter of a metal rod or plastic cylinder by pulling it through perforations of successively diminishing size in a series of plates", and "an analogous method is used in sheet-metal forming". The first definition refers to the claimed drawing method. The second definition refers to a method of shaping a metal sheet by hammering and spreading it, which is not a processing method used for production of a metal wire. A common metal sheet is produced by rolling. Other definitions of "draw" include "to spread or elongate by hammering or by

pulling through dies", also "to shape by stretching or by pulling through dies" (www.merriam-webster.com/dictionary/draw), and "to flatten, stretch, or mold by hammering or die stamping", or "to shape or elongate by pulling through dies" (http://education.yahoo.com/reference/dictionary/entry/draw).

Moreover, "deep drawing" as disclosed in Housh is a processing method of forming a cup, for example, by pressing a metal sheet against a die using a punch. Thus, while Housh mentions the formability of "sheet" and "deep drawing" of magnesium alloys, Housh fails to teach or suggest "drawing" a wire. Thus, House does not disclose the heating temperatures for drawing carried out on a wire, or the wire obtained by drawing.

Since favorable processing temperatures vary depending on processing methods, and even though Housh discloses "deep drawing" at temperatures that overlap those used in the claimed drawing method, a skilled artisan would not be motivated to practice the claimed drawing method for a wire based on the teachings of Housh. Nor would one skilled in the art easily conceive applying such Housh's temperatures to the heating temperatures at the time of screw working.

Furthermore, the magnesium-based alloy of amended claim 1 and those in the disclosure of Housh are different. The magnesium-based alloys of amended claim 1 are limited to those of AZ61 or AZ91. In contrast, Housh uses AZ31B-H24 of Table 18, in which the Al content is as low as 3.0% (see, "Introduction" Table 3 of Housh).

It was asserted that a skilled artisan would find a magnesium-based alloy should be worked at temperatures as high as over 250 °C if they contained Al at 5.5% or more, such as shown in samples AZ61 and AZ91. The document "Development of High Strength Magnesium Alloy Wire" by OISHI et al., which was submitted in the November 17, 2010 IDS, shows the

relationship between annealing temperature and tensile properties of AZ31 alloy wire and AZ61 alloy wire in Figs. 4 and 5 respectively. The document states, on page 56, lines 2-5 and 11-14 of the left hand column, "for AZ31 alloy, the property of the annealed wire at a temperature of 200 °C", "for AZ61 alloy, that of annealed wire at a temperature of 250 °C", and "the lowest annealing temperature that can recover the elongation of AZ61 shifted to a higher temperature as compared with AZ31 alloy".

Fig. 5 of OISHI shows that the elongation (EL) and reduction of area (RA) of AZ61 alloy increase as the temperature exceeds 300 °C. This indicates that a skilled artisan would find that such alloys as AZ61 alloy, which has higher Al content as compared with AZ31 alloy, should be worked at high temperatures exceeding 300 °C for easy and effective plastic processing. As such, if magnesium-based alloys had compositions of AZ61 or AZ 91, one of ordinary skill in the art at the time of the invention was made would certainly by motivated to work the alloys at high temperatures exceeding 300 °C. However, the tensile strength of the AZ61/AZ91 magnesium alloys would decrease due to the high temperatures in such a case, and obtained screws would not have a tensile strength of 220MPa or higher.

In contrast, a screw of claim 1 can achieve superior strength since it is worked at temperatures lower than 250 °C at which grain growth is suppressed and grain structure is prevented from becoming coarse. Further, a screw having tensile strength of 220MPa or higher can be obtained.

Therefore, as is well known, in order to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. As Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. do not disclose a magnesium-based alloy screw formed from a drawn wire made of a made from a

magnesium based alloy which has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less, and the magnesium based alloy contains Al: 5.5 to 7.2% by mass, Zn: 0.4 to 1.5% by mass, Ni: 0.05% by mass or less, and Si: 0.1% by mass or less, or the magnesium based alloy contains Al: 8.1 to 9.7% by mass, Zn: 0.35 to 1.0% by mass, Mn: 0.13% by mass or more, Cu: 0.1% by mass or less, Ni: 0.03% by mass or less, and Si: 0.5% by mass or less, it is apparent that Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. fails to render amended claim 1 or any dependent claims thereon obvious. Accordingly, the Applicants respectfully request that the § 103 rejection be traversed.

III. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as amended claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

IV. Conclusion

Having responded to all open issues set forth in the Office Action, it is respectfully submitted that all claims are in condition for allowance.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper,

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including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP

Nathaniel D. McQueen
Registration No. 53,308

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 NDM:MWE
Facsimile: 202.756.8087
Date: April 18, 2011

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